Plant for cooling milk with cooling machines and a milk-cooling tank cools even small quantities of milk directly while flowing in over a protracted period of time.

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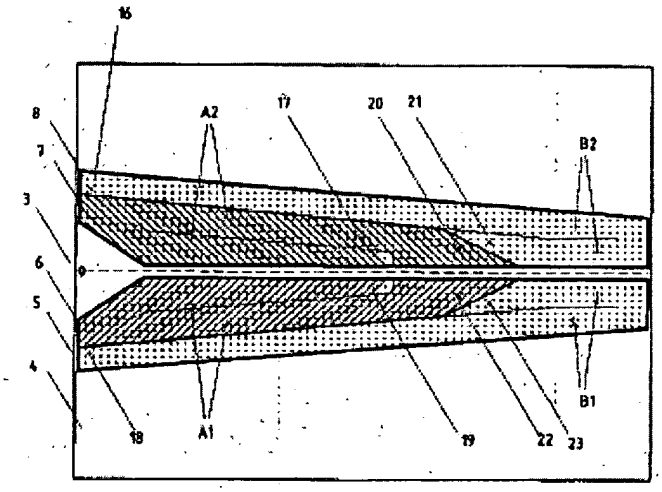
Abstract of **DE10039014**

A milk-cooling tank has vaporizer cooling trays for direct vaporizing and ducted coolants. Vaporizer tray sections (5-8) fitted alongside each other in one area of a milk tank cooling tray (4) to form a vaporizer cooling tray have inner sides slanted towards a milk flowing-out hole (3). This slant allows small amounts of milk to collect at the milk flow-out hole in a recessed flowing-out hole area.



Result Page

The present invention relates to a milk cooling system consisting of at least one refridgerator and a milk cooling tank with outside lagging, in particular for automatic milking systems for cows (milking robot systems), under direct evaporation in one or more evaporator cooling soils of the Milchkühltankes in one or more refrigerant ways of obligation-led refrigerant, with one or more individual divided and insertable as well as disconnectible, in particular plattenförmigen evaporator cooling soils, whereby according to the fill level of the milk cooling tank those evaporator cooling soils is cooled, against which milk it rests, as well as and whereby the refrigerant evaporated is sucked in over an electrical engine compressor and consolidated and in a capacitor is liquefied and over a thermostatic expansion valve eased afterwards under cooling of the milk in these, lining up over that or the evaporator cooling soils, again is evaporated, and whereby a regulation of the output of the compressors of this refridgerator takes place in accordance with the necessary cooling temperature of the milk by means of a thermostat with temperature sensor at least for in and Endabschaltung, which is arranged at an evaporator cooling soil at as deep a point in the milk cooling tank as possible and the there surface temperature measures and/or the adjusting milk temperature.

A milk cooling system that managing described kind for conventional milking systems, with which usually only twice 2 to 2.5 hours on the day one milks and with larger milk cattle enterprises twice on the day large milk quantities during 2 to 2.5 hours on the day to result in each case thus in particular, is in accordance with the DE 27 57 726 A1 well-known.

It takes place there for cooling the milk a precooling directly without buffer tank at the evaporator heat sinks of the tank.

In milk cooling tanks of conventional milk cooling systems the cooling takes place both by means of heat sinks in the floor part and in the side walls, whereby before beginning of the cooling as much fluid must be led into the milk cooling tank, until at least the heat sinks of the vaporizer are covered in the floor part, since otherwise because of mangle at thermal load the evaporation temperature sinks under 0 DEG C and must on freezing out features be counted.

With frozen milk the fat particles are damaged, the portion of free fatty acids in the milk increase, whereby an aqueous milk develops.

Since contrary to the conventional milking technology with a milking robot (automatic milking systems for cows, AMS) only small milk quantities per hour are milked, with an a box plant z. B. , a 10%-ige tank filling would know only 100-120 litres of milk per hour and/or. the cooling beginning with a conventional cooling tank only after 5-8 hours reached its.

The cooling would thus be used much too late, there in accordance with the ISO 5708 won milk as quick as possible, maximally however within 3 hours up to 4 DEG C be cooled down must.

Since with automatic milking procedures the milk results quasi approximately as relatively thin rivlet around the clock, however the necessity results to begin in the case of small milk quantities with the cooling if possible the time ago, at which the agitator of normal way can mix the milk.

Plants with direct cooling must be adapted to the automatic milking procedure (AMV) (milk practice, 38. Class, (1) 2000, ?milk cooling: Directly or indirect ones? ?). It applies to adapt and this before all around to beginning of filling the tank freezing on at the heat sink avoid the cooling compared with conventional milking procedures to slower influxes of the milk.

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In order to shorten the time interval up to reaching normal agitator functions and for switching on of the cooling on, smaller Vorbehälter (buffer tank) before the main warehouse container is to be necessary in accordance with this literature place for the adjustment of the direct cooling to the automatic milking procedure.

Additionally the milk in a flow through fresh water can be first precooled.

On the basis of the plant for cooling milk in accordance with the DE 27 57 726 A1, whereby precooling takes place directly without buffer tank at the evaporator heat sinks of the tank, the present invention the task is thus the basis to create a milk cooling system consisting of at least one refridgerator and a milk cooling tank with direct cooling which is suitably trained for automatic milking systems.

It should be possible a cooling, which is adapted to slower influxes of the milk in particular.

Are to that extent in particular milk cooling tanks, and/or. a milk cooling system for it for milk cattle enterprises, with which the milking is made by automatic milking systems (milking robots), to be created, whereby the milked milk not during individual shorter periods of z, distributed over the day. B. 2-2,5 hours one collects and one cools and not in larger quantities results, but in smaller continuous or also discontinuous resulting, slowly milk quantities and this flowing in into the tank from the milking system during considerable longer period, which extends nearly over the entire day (z. B. 20-22 hours).

In order not to affect the automation of the milking system unfavorably, the milk cooling is to be as constantly as possible ready. Already very small milk quantities should be coolable in the tank, whereby before cooling beginning the accumulation of a larger minimum milk quantity does not have to be necessary, how this is with conventional milk cooling tanks the case, where first a minimum amount of filling (of z. B. 10%) to be reached must.

To that extent an adjustment of the cooling system is to actually be present resulting in large fluctuations of the hourly milk yields.

Furthermore the milk cooling system should be also already as briefly as possible in dry condition (without milk) operable, thus before the milk supply switching on and adjustably.

This should be possible without inset and without the danger of the excessive condensation or freezing on the milk in the cooling tank.

A mixing of the milk should not be necessary with the given smaller milk quantities to that extent.

The cooling performance is if possible without a current and/or. Speed regulation of used compressors possible its, whereby with to large

reduction of the existing, milk quantity which can be cooled a disconnection one is to only take place or several compressors or a bare throttling via creation of a bypass line, in order to reduce evaporation cold weather.

Despite to that extent possible large fluctuations of the additionally resulting hourly milk quantity the cooling and storage of the milk in the milk cooling tank and thus their quality are not to be impaired.

For the solution of this task the construction of a milk cooling system of the kind initially specified is intended in accordance with claim 1.

The milk cooling system planned to that extent exhibits a particular milk cooling tank, whereby only in the milk tank cooling soil evaporator heat sinks are put on and an evaporator cooling soil is used, which is compound from individual evaporator soil segments or exhibits such.

The value and arrangement of the evaporator soil segments effected under plant of a deepened discharge range of the milk tank cooling soil in that lining up very small milk quantities of effective to be cooled can, without Kondens forms or the milk freezes on.

The construction of a deepened discharge range forwards and laterally the milk discharge in the milk tank cooling soil results already in the case of conventional milk tanks, there these in the cross section approximately or oval is and thus in the case of an additional intended inclination of the Milchkühltankes and/or. the inside of the milk tank cooling soil to the milk discharge before the milk discharge the necessary deepened discharge range for the accumulation of coolable small minimum milk quantities arises.

As a result of suitable control and conception of the refrigerators which can be used an optimal cooling of the milk, in particular also from small milk quantities per time unit, arises which are milked by the milking robot.

These minimum quantities correspond at least to the milk quantity of a cow, which was not milked yet. The milking robot recognizes thereby cows, which were already milked and such selects with residues.

The value of the evaporator cooling soil and in particular the evaporator soil segments within the range of the deepened discharge range can be co-ordinated additionally with the small milk quantities resulting if necessary.

Due to the used particular form of the evaporator soil segments and in particular to that extent devoted deepened discharge range to the milk discharge it is guaranteed that already small milk quantities to a large extent cover heat sinks in the evaporator soil, which can be switched on.

The milk cooling tank is to that extent in such a way designed that also already very small milk quantities concentrate within a certain soil range to be able in order are cooled there without danger of freezing on and the education a control suitable by condensate over and with suitable conception of the refrigerator effective.

Furthermore the evaporator cooling soil is preferably split in the deepened discharge range, in order to be able to attach two cooling circles to it.

To that extent available two lower evaporator soil segments are individually insertable or disconnectible and exhibit from each other separated refrigerant ways of individual cooling circuits.

These are supplied either via a common or via several separately and disconnectible engine compressors.

As a result of the additional refrigerant ways arise a Zwangsführung, a control and a distribution of the refrigerant. Thus current and distribution of the refrigerant for the application purpose can be ensured.

In principle also an evaporator soil without pitch can find into two refrigerant cycles use.

The refridgerator is in such a way dimensioned of their output that it is co-ordinated with the value evaporator cooling soil and milk quantity which can be cooled of the optimal.

If an evaporator cooling soil with two cooling circles is selected, the refridgerator has two compressors, which are switched on dependent on the amount of filling of the tank and/or the milk temperature in the tank.

With very small milk quantities of the milking robot only one of the two compressors connects.

There except the milk temperature also a measuring of the evaporation temperature and/or the partial pressure of the refrigerant in the evaporator soil segments (evaporation cold weather) effected, in order to steer the output of the engine compressors as a function of these measured variables, can take place a prevention from ice formation on the heat sinks of the evaporator also with actually to small lining up milk quantities, whereby the cooling is switched on only at short notice, the system quasi ?thinks?.

The control of the output of the engine compressors is not made first directly by a governor of the electrical drive of the engine compressors. Furthermore also not by a reduction of the adjustment of the used expansion valve, but only by bare throttling of the cooling capacity of the engine compressors over a bypass.

To that extent according to claim 2 is intended that parallel to the regulation of the cooling performance a hot gas bypass line with solenoid valve for a hot gas injection is pumpable in to the engine compressor which can be throttled a wire led, and/or that under taking place disconnection or the engine compressors at to deep evaporation temperatures at least too this compressors in to it parallel a wire led Niederdruckpressostat put on under change of the pressure is more switchable.

According to claim one 3 is intended a speed regulation of the air-cooled capacitor, in order to thus hold the liquefaction pressure of the refrigerant constant.

In accordance with the claims 5-12 favourable constructions of the evaporator of cooling soil as well as the used evaporator soil segments are intended in addition.

Generally according to claim 13 also the milk supply can take place first in a buffer tank, in particular with precooling system, before then the cooling takes place in according to invention trained the milk cooling tank.

Claim 14 concerns the storing of the Milchkühltankes in such a manner that the inside of the milk tank cooling soil and/or. the there evaporator cooling soil the necessary inclination to the milk discharge exhibits, whereby is intended, to store the milk cooling tank at its ends in different height so that the necessary downward gradient of its inside results to the milk discharge.

The invention is more near described in the following on the basis a preferential embodiment of the milk cooling system determined as milk cooling tank for automatic milking systems for cows on the basis the designs, whereby several modifications of the evaporator soil are represented.

In the designs show

Fig. 1 a plan view on the inside of a first embodiment of the milk tank cooling soil, which is formed from four evaporator segments to the

- milk discharge extended and, which are put on in an oblong lower section of the milk cooling tank soil and itself there mirror-symmetrically to the central longitudinal axis and/or. the there lower crown of the tank inside laterally extend;

Fig. 2a the control circuit for two in the refridgerator of the milk cooling system used compressors over Pressostate;

Fig. 2b the circuit of the speed regulation of the engine of the air-cooled capacitor and the refridgerator;

Fig. 3a, b, C a profile and a cross section of the milk cooling tank as well as a plan view on the milk tank cooling soil in accordance with Fig. 1, under display of the inclination of the milk tank cooling soil to the milk discharge and the plant of four evaporator soil segments, in particular under suggestion of two different milk levels, with which only the two lower or also the two upper evaporator soil segments are covered with milk, whereby cross section and plan view are represented on the right of the cooling soil axle center as half-section only with the part;

Fig. 4a, b, C sectional views and the list of an empty milk cooling tank, in which only the two in the lower part of the evaporator cooling soil of the Fig. 1 of intended evaporator soil segments are put on, in along and cross section with display of the inclination of the milk tank cooling soil and/or. its inside to the milk discharge and under reproduction of a cross section opinion on the milk tank cooling soil;

Fig. ä, b C displays of the Milchkühltankes according to Fig. 4a, b, C in profile, cross section and in a cross section opinion on the milk tank cooling soil under display of the milk level with a given small milk quantity (z. B. of only two cows), whereby a larger part of the evaporator cooling soil before the milk discharge is covered with milk already;

Fig. 6a, b, C displays according to Fig. 5a, b, c, wobei nunmehr eine grössere Milchmenge im Bereich des gewölbten und des geneigten Milchtankkühlbodens bzw. the evaporator cooling soil planned there is covered with milk;

Fig. 7a, b, C displays according to Fig. ä, b, C and Fig. 6a, b, C, whereby now the entire evaporator cooling soil is covered with milk;

Fig. 8a, b, C displays according to Fig. 7a, b, C, whereby a larger evaporator cooling soil is intended, which with its tapering end up to the milk discharge facing the front wall of the milk cooling tank extends;

Fig. 9 the refrigerant cycle pattern used in the refridgerator of the milk cooling tank and the cooling soil.

In the side view, in the cross section as well as in plan view represented milk cooling tank 1 in accordance with Fig. 3a, b, C to Fig. 8a, b, C possesses as in the there cross section opinions in accordance with Fig. 3b, 4b, 5b, 6b, 7b, to recognize 8b a curved milk tank cooling soil 4, which extends upward to the side walls.

The milk cooling tank 1 is stored on differently high feet, which forward the milk discharge 3 becomes smaller in their overall height, so that the milk cooling tank 1 exhibits a milk tank cooling soil 4 to the milk discharge, which with its inside 10 to the milk discharge 3 forward is bent.

Due to this inclination of the milk tank cooling soil 4 to the milk discharge 3 and its curvature to its external walls (more approximately and/or. oval cross section), collects itself already with intake of a small milk quantity, z. B. the milk quantity sufficient of two milked cows, which in the receiving vessel or the piping of the automatic milking system resulted, on, in order one to the milk discharge deepened milk discharge range 9 in the evaporator tank cooling soil to cover, which extends forward opposite to each other between two bent lateral sections of the evaporator cooling soil and up to at the milk discharge 3 front wall of the Milchkühltankes lain.

In Fig. this dammed up milk quantity is black schattiert shown ä, b, C.

Above the evaporator cooling soil 2, which is formed for 4 evaporator soil segments put on 6, 7 from two facing, within a middle longer range of the milk tank cooling soil there, with this milk quantity only of its front section, can these small milk quantities already effective is covered with milk be cooled, without condensate forms or the milk freezes on.

The milk cooling tank 1, which is intended for milking robot systems for automatic milking systems (AMS) and thus, differs opposite conventional milk cooling tanks in particular in as much as the evaporator cooling soil 2 is put on only over a smaller portion of the milk tank cooling soil 4, whereby a larger part of the milk tank cooling soil 4 is not trained with an evaporator cooling soil and in particular also the side walls of the Milchkühltankes 1 do not exhibit a cooling equipment. Due to good lagging of the tank wall this heat sink is also sufficient, in order to cool a filled tank further sufficiently.

Contrary to the evaporator cooling soils 2 of the Milchkühltankes in accordance with Fig. 4a, b, C - Fig. 8a, b, C, which is mirror-symmetrically evaporator soil segments 6, 7 put on to the lower crown 30 in the tank inside trained only from two and to the front wall of the tank within the range of the milk discharge 3 widen themselves and deepen, exists the evaporator cooling soil 2 in accordance with Fig. 1 and Fig. 3a, b, C from two lower evaporator soil segments 6, 7 and two additional, above and laterally outside of evaporator soil segments put on by it 5, 8, whereby also more than four evaporator soil segments are possible.

Due to only the evaporator cooling soil 2 as well as its particular construction intended within the range of the milk tank cooling soil 4 result substantial differences in the structure opposite Milchkühltankes from milk cooling tanks for conventional cooling systems.

The milk cooling tank 1 has one already on very small milk quantities co-ordinated evaporator cooling soil 2 which can be cooled, whereby for this in particular the angle of inclination is alpha to the milk discharge 3 in relation to the horizontals the environment of importance. This angle of inclination is in particular in the profile in accordance with Fig. 3a shown.

The evaporator cooling soil 2 in accordance with Fig. 1 consists itself to that extent of two front shorter, directly laterally from the milk discharge 3 the inside the milk cooling tank 1 extending in relation to the remaining range of the milk tank cooling soil 4 more deeply lying evaporator soil segments 6, 7. These are laterally put on along the lower crown 30 of the tank inside and face each other thus mirror-symmetrically, whereby they exhibit appropriate mirror-symmetric forms.

They form as in Fig. 4a, b, C and Fig. ä, b, C a deepened milk discharge range 9 in the milk tank cooling soil 4, whereby due to the inclination of the milk tank cooling soil 4 the flowing milk flows off there.

The moreover the evaporator cooling soil 2 exists in this embodiment of two additional outside, 7 evaporator soil segments put on 5, 8 additional above the two lower evaporator soil segments 6. At that the milk discharge 3 turned away end of the milk cooling tank 1 these approach directly one on the other with a larger section toward the lower crown of the tank inside and are otherwise led with a narrower range laterally up along the lower evaporator soil segments 6, 7 up to the front wall of the Milchkühltankes in the range of the milk discharge 3.

These four different evaporator soil segments 5, 6.7, 8 are directly in the milk tank cooling soil 4 through accordingly led circulating transverse walls in an educated manner, which in the sand yield-like developed milk tank cooling soil 4 between an outside and internal base plate 4a, b are welded.

These evaporator walls screen end base plate 4a, b are to each other held in conventional way with their insides in spacing, whereby these

are in such a manner beabstandet one on the other welded that within the range between these, forming the evaporator cooling soil, the refrigerant ways between injection line connections 16, 17, 18, 19 and intake connections 20, 21, 22, 23 run.

The evaporator soil segments can as in accordance with Fig. 1 divided into the example of the two internal lower evaporator soil segments 6, 7 implemented, additionally by one inside running longitudinal wall 6a, 7a its.

Die über die Oberfläche der Verdampferbodensegmente 5, 6, 7, 8 regelmässig angeordneten Rasterpunkte stellen jeweils Schweissverbindungen zwischen den beiden äusseren und inneren Bodenplatten 4a, 4b dar, wie dies bei Verdampferplatten herkömmlicher Milchkühltanks bekannt ist.

Wie in Fig. 3a schematically represented by a drawn in deeper milk level 25, is covered with an accordingly smaller milk quantity only the surface A1 and a2 of the evaporator soil segments 6, 7 with milk.

On the other hand the surface A1 and a2 of the lower part of the evaporator cooling soil formed by the evaporator soil segments 6, 7 are covered with milk, and the surfaces B1 and B2 of the upper evaporator soil segments 6, 7 with the larger milk quantity in accordance with the higher milk level 24 both.

The form of to that extent quadruple divided evaporator cooling soil 2, and/or. the four intended evaporator soil segments it is in such a manner selected 5, 6, 7, 8 that under filling of the smaller milk discharge range 9 already small milk quantities can be cooled above the lower evaporator soil segments 6, 7, whereby this range of the evaporator soil segments is already covered already by the milk of fewer cows.

Die genaue Form des Verdampfer-Kühlbodens und dessen Verdampferbodensegmente ist abhängig von der Tankform, insbesondere von dessen rundem oder ovalem Querschnitt.

The particular structure of the Milchkühltankes and its evaporator cooling soil 2 within the larger milk tank cooling soil 4 in connection with a particular control and construction of the refrigerator which can be used provides for a correct cooling of the milk, in particular also from small quantities per time unit, which will ermolken of the automatic milking system.

To that extent it is on the one hand reached that itself on the evaporator cooling soil already with very small milk quantities, z. B. of two cows, no condensation and egg to form knows. It is possible, the evaporator cooling soil also at short notice for dry, D. h. without cooling milk, whereby the particular intended control and conception of the refrigerator lead to the fact that also without and disconnection of the compressors and/or speed regulation their cooling is limitable, whereby a bare regulation is made by a solenoid valve in a bypass line between sucking and print pages of the compressors, headed for by means of Niederdruckpressostate.

Diese Regelung ermöglicht auch die eingesetzten Kompressoren vor unzulässigen Betriebszuständen zu schützen, welche zumindest zu einer deutlichen Verkürzung der Lebensdauer der Kältemaschine führen würde.

Although into the Fig. 3a, b, C to 8a, b, C only milk cooling tank 1 in the form of lying milk containers are represented, can natural milk containers also standing be used, if it is guaranteed that an inclination of the interior soil to the milk opening is given.

As in Fig. 1 and Fig. 3a, b, C as well as Fig. 8a, b, c dargestellt, kann der Verdampfer- Kühlboden sich über die gesamte Länge des Milchkühltanks erstrecken, also unmittelbar zwischen den beiden sich gegenüberliegenden Stirnwandungen des Tanks.

The evaporator soil segments can either directly like first described within facing the outside base plates 4a, b of the evaporator of cooling soil 2 put on are, whereby they are trained to that extent einstückig with the evaporator cooling soil, or also as quadruple divided evaporator plates, which in each case a surface area in accordance with Fig. 1 and/or. Fig. 4c exhibit, whereby this in the cross section seen in each case a suitable curvature part to possess and thus the tray in accordance with Fig, curved in the cross section. 3b, 4b, 5b, 7b, 8b form, to which they are to be joined together laterally suitably.

By the described pitch of the evaporator soil in two-way and/or. 4-fach oder auch 6-fach geteilte Verdampferplatten bzw. Evaporator soil segments 5, 6, 7, 8 an optimization of the working conditions and cooling performance takes place.

For the further optimization of the working conditions of the evaporator cooling soil this is equipped with additional refrigerant ways (Zwangsführung).

Thus the current and distribution of the refrigerant for the intended application purpose can be ensured.

The refridgerator is so dimensioned that it is co-ordinated with the evaporator cooling soil optimal. The evaporator cooling soil 2 possesses to that extent in the embodiment in accordance with Fig. 1 and 3a, b, C two compressors 11, 12, which can be switched on dependent on the amount of filling of the milk cooling tank 1 and/or the milk temperature in the milk cooling tank 1.

The control circuit for the two compressors by means of Pressotate, used in the refridgerator, been made by Niederdruckpressostate 27 ', 28 ', which in wires 27, 28 is put on, those parallel to the engine compressors 11, 12 from their suction face led to the print page are.

The air-cooled capacitor 13 points toward it only a speed regulation in accordance with circuit after Fig. 2b up, whereby additionally for the compressors 11, 12 a speed regulation is not intended.

The cooling circle exists 11, 12 and the air-cooled capacitor 13 of two thermostatic expansion valves 14, 14 ' as well as an electronic thermostat 15, an agitator engine 29, a dryer 34, two feelers 36, 36 ' for the expansion valves 14, 14 ' except from the engine compressors, two suction gas distributors 37, 37 ', an air flow automatic controller 38 with monitoring and two Frostschutzpressostaten 39, 39 '.

For the additional prevention of ice formation and around an optimal function to ensure, is the refridgerator equipped with a special equipment, which is not used in conventional plants, or partly only then is used, in order to react to low ambient temperatures.

This special equipment consists of mentioned Niederdruckpressostaten 27 ', 28 ', to hold which then switched, if the temperature in the vaporizer sinks too deeply, furthermore from governors for exhaust engine air-cooled capacitor 13, in order thus liquefaction pressure refrigerant constant, and from additional regulation, with which, if the engine compressor 11, 12 on low pressure is switched off, the refridgerator also the agitator engine switches off, in order to prevent an air impact and thus a damage of the milk.

Alternatively to the regulation with Niederdruckpressostaten 27 ', 28 ' a regulation is put on, which does not switch the engine compressor off in the case of a too deep evaporation temperature, but over a hot gas bypass line 26 not into the evaporator cooling soil, but leads back this pumps the refrigerant over Bypassventile (solenoid valves 26 ', 26 ") on the intake of the engine compressors 11, 12 of the refridgerators until the normal work situation is again reached.

The entire regulation of the refridgerator and in particular and the disconnection of the engine compressors 11, 12 take place first in accordance with the surface temperature, which is based on one of the evaporator cooling soils, which is particularly deeply been appropriate and corresponds thus for the milk temperature.

Subsequently, is then made a regulation of the temperature of the heat sinks or the evaporator soil segments by a regulation of the output of the engine compressors except as a function of the milk temperature also under measuring of the evaporation temperature and/or the pressure of the refrigerant in the evaporator soil segments (evaporation cold weather) and in dependence of these values.

With milk becomes too cool as a function of the milk temperature and/or. der Verdampfungskälte das Kältemittel solange zurückgeführt, bis die normale Arbeitssituation wieder erreicht ist, wobei die Leistung der Kältemaschine bzw. the engine compressors 11, 12 throttled and/or. one switches off.

Die Konstruktion des Milchkühltanks 1, insbesondere gemäss Fig. 1, 3a, b, C and Fig. 4a, b, c, und die Schaltungen gemäss Fig. 2a, b brings the following advantages for the enterprise to the plant:

1. Ausrüstung mit zwei relativ kleinen Kompressoren im Vergleich mit einer herkömmlichen Milchkühlanlage. The electrical connected load of a farm can be smaller thereby whereby costs are saved.
2. With very small milk flow rates, which switches itself 11, 12 for one on of the engine compressors from the milking robot inflows, first only.
3. A low Schaltzahl of the engine compressors is given to 11, 12 and a high life of the refridgerator and the engine compressors.
4. Es erfolgt eine bessere Anpassung der Kompressorstärke am Kühlboden. With the fact it is possible that the plant a certain time is already operated also in the ?dry condition? (thus without milk) before the milk supply, without in the cooling tank of egg sets.

The total conception is applicable as all-round system for the milk cooling of milking robots.

Is not an additional precooling system necessary, but actually usable.

Even if beside the milk cooling tank 1, as in Fig. 4c suggested, a special buffer tank 32 with a precooling system 31 applicable, is the described solution without buffer tank and without precooling system the better variant, since without special construction of the Puffertankes the same problems as with can occur there conventional milk cooling tanks, which above is described.

Des weiteren ist ein besonderer Puffertank insofern nicht notwendig, als der Milchkühltank 1 nur mit geringen Milchmengen pro Zeiteinheit befüllt wird.

The milk cooling tank is adapted to particular to automatic milking systems, whereby the milk cooling is constantly ready and not dependent on the fill level of the milk within the milk cooling tank to take place and must begin.

Es ist insofern im Gegensatz zu Standardkühltanks der herkömmlichen Melk- und Kühltechnik nicht mehr notwendig, dass die Kältemaschine erst dann zugeschaltet wird, wenn die Rührwerkblätter des Tanks mindestens zur Hälfte in die Milch eintauchen. Der Milchstand kann insofern bedeutend geringer als 10% der Tankmindestfüllmenge sein, die in herkömmlicher Weise vor Einschaltung des Kühlaggregates bisher verlangt wird.

To that extent the milk cooling tank is adaptable to large fluctuations of the hourly milk yields, which can result obligatorily in the case of automatic milking systems.

Die beiden verwendeten Motorkompressoren 11, 12 können einen unterschiedlichen Anschlusswert besitzen. Bei sehr kleinen Milchdurchflussmengen von Melkroboter schaltet sich auch hier lediglich einer der beiden Kompressoren zu.

With a time delay relay the switching frequency can be adapted to a minimum with preceding switching of the engine compressor off when the next switching on attempt.

A regulation of the engine compressors with a hot gas bypass line is only necessary starting from certain levels of fuel in the tank (tank sizes) additionally.

To the fuse of the engine compressors 11, 12 Frostschutzpressostate 39, ', are intended 39 i.e. if the engine compressor is switched off, which reasons also always in the refrigerant cycle, if the temperature in the vaporizer sinks too deeply (see to that extent also the electrical connection diagram design 2a, b).

Thus an ice formation one prevents. Over a speed regulation for the exhaust engines of the air-cooled capacitor 13 the liquefaction pressure of the refrigerant constant can be held.

Reference number list
1 milk cooling tank
2, 2 ' evaporator cooling soil of the milk cooling tank
alpha Neigungswinkel des Verdampfer-Kühlbodens
3 milk discharge
4 milk tank cooling soil
4a, 4b äussere und innere Bodenplatten
5, 6, 7, 8 evaporator soil segment (z. B. as evaporator plate quadruple divided)
6a, 7a Längswandungen
9, 9', 9" vertiefter Milchauslaufbereich im Milchtankkühlboden
10 inside
11, 12 Motorkompressoren
13, 13 ' air-cooled capacitor
14, 14' Expansionsventil, thermostatisch
15, 15 ' thermostat with feeler
16, 17, 18, 19 injection line connection
20, 21, 22, 23, 24, 25 intake connection milk level (surfaces A1 and a2 of the lower part of the evaporator cooling soil with milk covers and/or. deren Verdampferbodensegmente (6, 7)) Milchniveau (Fläche B1 und B2 des oberen Teils der Verdampfer-Kühlboden mit Milch bedeckt bzw. their evaporator soil segments (5, 8) as well as surfaces A1 and a2)
26 hot gas bypass line
26', 26" Magnetventil
27, 28 wire for the Niederdruckpressostate
27 ', 28 ' Niederdruckpressostat
29 Rührwerkmotor
30 untere Scheitellinie im Tankinneren
31 precooling system
32 buffer tank

33 liquid collecting tanks
34 dryers
35 Schauglas mit Feuchtigkeitsindikator
36, 36' Fühler vom Expansionsventil (14, 14')
37, 37 ' suction gas distributors
38 air flow automatic controllers with monitoring
39, 39 ' Frostschutzpressostate

Result Page

1. Milk cooling system consisting of at least one refridgerator and a milk cooling tank (1) with outside lagging, in particular for automatic milking systems for cows (milking robot systems),
under direct evaporation in one or more evaporator cooling soils (2) of the Milchkühltankes (1) in one or more refrigerant ways of obligation-led refrigerant,
with one or more individual divided and insertable as well as disconnectible, in particular plattenförmigen evaporator cooling soils (2),
whereby according to the fill level of the milk cooling tank those evaporator cooling soils (2) is cooled, against which milk rests,
and the refrigerant over an electrical engine compressor (11, 12), evaporated, is sucked in and consolidated, liquefied in a capacitor (13) and as well as eased over a thermostatic expansion valve (14, 14 ') afterwards under cooling of the milk in these, lining up over that or the evaporator cooling soils, is again evaporated,
and whereby a regulation of the output of the compressors (11, 12) of this refridgerator takes place in accordance with the necessary cooling temperature of the milk by means of a thermostat (15) with temperature sensor at least for in and Endabschaltung, which is arranged at an evaporator cooling soil (2) at as deep a point in the milk cooling tank as possible (1) and the there surface temperature measures and/or the adjusting milk temperature, characterised in that
for immediate cooling both smaller milk quantities flowing slowly per time unit more resulting and and larger milk quantities within a range of the milk tank cooling soil (4) as evaporator cooling soil (2), which can be covered with milk, evaporator soil segments (5, 6, 7, 8) next to each other arranged it are, also to the milk discharge of the Milchkühltankes bent insides (10) whose inclination to the milk discharge (3) and their form is in such a manner selected that already very small milk quantities collect themselves within a deepened discharge range (9) forwards and laterally the milk discharge (3), which is formed by mindest an evaporator soil segment changing into the milk discharge (3) (5, 6),
that with use of several evaporator soil segments (5, 6, 7, 8) these are put on individually insertable as well as disconnectible and into this separated refrigerant way of individual cooling circuits, which are produced over a common or several separately/disconnectible engine compressors (11, 12),
that to the regulation of the temperature or the evaporator soil segments (5, 6, 7, 8) the output of the engine compressors (11, 12) except as a function of the surface temperature of the evaporator soil segments (5, 6, 7, 8) (milk temperature) also under measuring of the evaporation temperature and/or the partial pressure of the refrigerant in the evaporator soil segments (5, 6, 7, 8) (evaporation cold weather) taken place as a function of it,
whereby under bare throttling and/or and disconnection of the engine compressors (11, 12) evaporation cold weather is more adjustable.

2. Milk cooling system according to claim 2, characterised in that
at to deep evaporation temperatures either without an elimination or the engine compressors (11, 12) the refrigerant parallel to the regulation of the cooling performance over a hot gas bypass line (26) with solenoid valve (26 ', 26 ") for a hot gas injection in to the engine compressor which can be throttled a wire led is pumpable, until the desired higher evaporation temperature is again reached,
and/or that under taking place disconnection or the engine compressors at to deep evaporation temperatures at least too this compressors in to it parallel a wire led (27, 28) Niederdruckpressostat put on (27 ', 28 ') under change of the pressure is more switchable.

3. Milk cooling system according to claim 1 or 2, characterised in that for the automatic constant of the liquefaction pressure of the refrigerant of the refridgerators in these an air-cooled capacitor (13) is intended, whereby exhaust engines of the capacitors (13), which
▲ top can be used, exhibit a speed regulation, in order to hold the liquefaction pressure of the refrigerant constant.

4. There milk cooling system according to claim 1, 2 or 3, characterised in that with a higher milk quantity within the discharge range at least one agitator engine (29) in the milk cooling tank put on and more switchable is, whereby if the engine compressor (11, 12) is switched to low pressure, the refridgerator also the agitator engine (29) switches off, in order to prevent an air impact and thus a damage of the milk.

5. Milk cooling system after one of the claims 1-4, characterised in that
the evaporator cooling soil (2) within the discharge range (9) or that or the there evaporator soil segments (5, 6, 7, 8) the form of an oblong, equal-leg triangle exhibits, which is cut off according to the tank front wall at the point
and to the tank inside in a value according to the inclination (alpha) of the evaporator cooling soil (2) for the milk discharge (3) and its cross section curvature runs out, whereby a first is assigned refrigerant cycle to the lower part (6, 7) of the evaporator cooling soil (surface A1 and a2) and a second refrigerant cycle the remaining part (5, 8) (surface B1 and B2) of the evaporator cooling soil (2), in order to optimize the Zwangsführung, current and distribution of the refrigerant for the application purpose,
and whereby only one refridgerator with two compressors (11, 12) or two separate refridgerators is intended, which are dependent on the amount of filling of the Milchkühltankes and/or the milk temperature and/or disconnectible.

6. Milk cooling system after one of the claims 1-5, characterised in that the section of the evaporator cooling soil within the discharge range (9) into two evaporator soil segments (6, 7) is divided, which are attached to one or two refrigerant cycles.

7. Milk cooling system according to claim 5 or 6, characterised in that laterally above or the evaporator soil segments (6, 7) the deepened discharge range (9) or two additional, these partly surrounding evaporator soil segments (5, 8) put on is.

8. Milk cooling system after one of the claims 1-7, characterised in that centrically along the milk tank cooling soil (4) (tank cooling soil axle center) the lower crown (30) of the tank inside led is and laterally on the right of and left in addition in each case two into one another lateral and in longitudinal direction shifts arranged, oblong lower and upper evaporator soil segments (5, 6; 7, 8), whereby an allocation of the there evaporator cooling soil (2) takes place to that extent separated into four evaporator systems with one or up to four to these engine compressors attached (11, 12) or Kühlmaschinen.

9. Milk cooling system according to claim 7 or 8, characterised in that the evaporator cooling soil (2) in or two front shorter, directly

laterally the milk discharge (3) opposite deeper evaporator soil segments (6, 7) divided is, which are in such a manner led up to the milk discharge (3) and which deepened milk discharge range (9) form, and in two laterally outside, above of it adjacent in each case outside evaporator soil segments (5, 8), which at that the milk discharge (3) turned away end approach directly one on the other and form a common additional upper milk collection section in the tank.

10. Milk cooling system after one of the claims 1-9, characterised in that the two internal lower evaporator soil segments (6, 7) and these under inclusion that or these upper evaporator soil segments surrounding outside (5, 8) and thus the entire arrangement from internal and outside evaporator soil segments (5, 6, 7, 8) to the milk discharge (3) widens itself and deepens.

11. 1-10, characterised in that the evaporator soil segments (5, 6, 7, 8) of the milk tank cooling soil (4) in the cross section from two evaporator disk walls held with their insides in spacing it exists milk cooling system after one of the claims in each case which are in such a manner welded with one another that between these the refrigerant ways with respective injection line connections (16, 17, 18, 19) and intake connections (20, 21, 22, 23) run.

12. Milk cooling system after one of the claims 1-11, characterised in that the evaporator soil segments (5, 6, 7, 8) of the milk tank cooling soil (4) according to the intended form of the Milchkühltankes and its milk tank cooling soil (4) (lying or standing milk cooling container) under inclination of the inside (10) trained as the milk discharge (3) with plattenförmigen interior soils and/or bent or curved interior soils and laterally joined together also to each other are.

13. Milk cooling system after one of the claims 1-12, characterised in that the milk supply into the milk cooling tank (1) indirectly over an additional precooling system and/or a buffer tank takes place.

14. Milk cooling system after equal one the claims 1-13, characterised in that the milk cooling tank (1) one over its length large tank interior height exhibits and to the milk discharge (3) is more deeply stored than to its other refuelling, so that the evaporator cooling soil (2) is bent within the tank to the milk discharge with continuous construction of the tank wall.